

main data including audio data and/or video data, which is later reproduced in synchronization with the main data; (b) reading extra data recorded in a separate bitstream from the main data and the sub data, which is later reproduced in connection with the main data; and (c) multiplexing the read sub data and the read extra data.

In this embodiment, it is preferable that the reproducing method further comprises (d1) outputting the multiplexed sub data and extra data through a digital interface, or (d2) decoding the multiplexed sub data and extra data.

In the reproducing method above, it is preferable that step (c) comprises: (c1) reading navigation information defining a relation required for the read sub data and extra data to be reproduced in connection with each other; and (c2) multiplexing the read sub data and the extra data based upon the navigation information.

The first object of the present invention is also achieved by a recording apparatus comprising: a recording unit for recording main data including audio data and/or video data, recording sub data to be reproduced in synchronization with the main data in a separate bitstream from the main data, and recording navigation information defining a relation required for the main data and the sub data to be reproduced in synchronization with each other; and a control unit for generating the navigation information and providing the generated navigation information to the recording unit.

It is preferable that the recording unit further records extra data to be reproduced in connection with the main data in a separate bitstream from the main data and the sub data, and records navigation information defining a relation required for the main data and the extra data to be reproduced in connection with each other. In this case, the control unit preferably generates the navigation information defining the relation between the main data and the extra data and provides the generated navigation data to the recording unit.

It is preferable that the recording apparatus further comprises a digital interface for receiving the main data and/or the sub data, and the digital interface receives the extra data, and the recording unit records the received extra data and navigation information on the extra data.

It is preferable that the recording apparatus further comprises an encoder for receiving and encoding the main data and/or the sub data.

The second object of the present invention is also achieved by a reproducing apparatus comprising: a reading unit for reading main data including audio data and/or video data and reading sub data recorded in a separate bitstream from the main data, which is later reproduced in synchronization with the main data; and a multiplexer for multiplexing the main data and sub data read by the reading unit.

It is preferable that the reproducing apparatus further comprises a digital interface for outputting the multiplexed main data and sub data, or a decoder for decoding the multiplexed main data and sub data.

In the reproducing apparatus, it is preferable that the reading unit reads navigation information defining a relation required for the read main data and sub data to be reproduced in synchronization with each other, and the multiplexer multiplexes the read main data and the read sub data based upon the navigation information.

To achieve the second object of the present invention, there is also provided a reproducing apparatus comprising: a reading unit for reading main data including audio data and/or video data, reading sub data recorded in a separate bitstream from the main data, which is later reproduced in synchronization with the main data, and reading extra data recorded in a separate bitstream from the main data and the sub data, which is later reproduced in connection with the main data; and a multiplexer for multiplexing the main data, sub data, and extra data read by the reading unit.

It is preferable that the reproducing apparatus above further comprises a digital interface for outputting the multiplexed main data, sub data, and extra data, or a decoder for decoding the multiplexed main data, sub data, and main data.

In the reproducing apparatus above, it is preferable that the reading unit reads navigation information defining a relation required for the read main data and sub data to be reproduced in synchronization with each other and required for the read main data and extra data to be reproduced in connection with each other, and the multiplexer multiplexes the read main data, the read sub data, and the read extra data based upon the navigation information.

Another reproducing apparatus according to the present invention comprises: a reading unit for reading sub data recorded in a separate bitstream from main data including audio data and/or video data, which is later reproduced in synchronization with the main data, and reading extra data recorded in a separate bitstream from the

main data and the sub data, which is later reproduced in connection with the main data; and a multiplexer for multiplexing the sub data and extra data read by the reading unit.

It is preferable that the reproducing apparatus above further comprises a digital interface for outputting the multiplexed sub data and extra data, or a decoder for decoding the multiplexed sub data and extra data.

In the reproducing apparatus above, it is preferable that the reading unit reads navigation information defining a relation required for the sub data and the extra data to be reproduced in connection with each other, and the multiplexer multiplexes the read sub data and the read extra data based upon the navigation information.

BRIEF DESCRIPTION OF THE DRAWINGS

The above objects and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG. 1 shows an example of data recorded on an optical disc according to a preferred embodiment of the present invention;

FIG. 2 shows the structure of navigation information showing the relation between main data, sub data, and extra data of FIG. 1;

FIG. 3 is a block diagram of a recording apparatus according to a preferred embodiment of the present invention;

FIG. 4 is a block diagram of a reproducing apparatus according to a preferred embodiment of the present invention;

FIG. 5 is a block diagram of a recording and reproducing apparatus according to a preferred embodiment of the present invention;

FIG. 6 is a flowchart illustrating a preferred embodiment of a recording method according to the present invention;

FIG. 7 is a flowchart illustrating another preferred embodiment of the recording method according to the present invention;

FIG. 8 is a flowchart illustrating a preferred embodiment of the reproducing method according to the present invention;

FIG. 9 is a flowchart illustrating another preferred embodiment of the reproducing method according to the present invention; and